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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte QIAN LIN, CLAYTON BRIAN ATKINS,
and DANIEL TRETTER

Appeal 2009-0147
Application 09/854,580
Technology Center 2600

Decided:[1] March 5, 2009

Before JOHN A. JEFFERY, CARLA M. KRIVAK, and ELENI MANTIS MERCADER, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-4, 6, 8-12, 14, 15, 18, 20, 21, 25, and 27-33. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

STATEMENT OF THE CASE

Appellants invented an image enhancement method to automatically enhance images of human faces so that that they have more pleasing lightness, contrast, and/or color levels. The method can also automatically reduce or remove any red eye artifacts in the image.[2] Claim 1 is illustrative:

1. An image enhancement method using face detection algorithms, comprising:

automatically detecting one or more human faces in an image using face detection algorithms;

automatically locating the one or more human faces in the image; and

automatically enhancing an appearance of the entire image by using a mapping technique to produce the image with target levels for a mean value or a variation value of the pixels in the one or more human faces, wherein the entire image is automatically enhanced such that the pixels in the one or more human faces have the target levels for the mean value or the variation value of the pixels.

The Examiner relies on the following prior art references to show unpatentability:

Fowler	US 5,410,618	Apr. 25, 1995
Acker	US 6,009,209	Dec. 28, 1999
Kado	US 6,181,806 B1	Jan. 30, 2001
Schildkraut	US 6,292,574 B1	Sep. 18, 2001 (filed Aug. 29, 1997)
Center	US 6,680,745 B2	Jan. 20, 2004 (effectively filed Nov. 10, 2000)

[2] *See generally* Spec. 1:18-29; Abstract.

1. The Examiner rejected claims 1, 2, 8-10,[3] 15, 21, and 27-33 under 35 U.S.C. § 103(a) as unpatentable over Schildkraut, Kado, and Fowler (Ans. 4-7).
2. The Examiner rejected claims 3, 4, 11, 12, and 18 under 35 U.S.C. § 103(a) as unpatentable over Schildkraut, Kado, Fowler, and Center (Ans. 7-8).
3. The Examiner rejected claims 6, 14, 20, and 25 under 35 U.S.C. § 103(a) as unpatentable over Schildkraut, Kado, Fowler, and Acker (Ans. 8-9).

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs and the Answer[4] for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

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[3] Although the Examiner omitted claim 9 in this rejection (and the other rejections on appeal), Appellants nonetheless indicate that this claim stands rejected (App. Br. 3; Reply Br. 3)—a status that the Examiner confirms as correct (Ans. 2 & 3). We therefore presume that the Examiner intended to include claim 9 in this rejection since (1) it depends from claim 8, and (2) the claim calls for a digital image—a feature that the Examiner indicates is present in Schildkraut. *See* Ans. 13 (noting that a human being would typically view the *digital images* as shown in Figure 1 of Schildkraut) (emphasis added).

[4] Throughout this opinion, we refer to (1) the Supplemental Appeal Brief filed Aug. 9, 2007; (2) the Examiner's Answer mailed Oct. 30, 2007; and (3) the Reply Brief filed Dec. 31, 2007.

THE OBVIOUSNESS REJECTION OVER SCHILDKRAUT, KADO, AND FOWLER

Claims 1, 2, 8-10, 27, 28, and 30-33

Regarding representative claim 1,[5] the Examiner indicates that Schildkraut discloses an image enhancement method with a face detection algorithm with all of the claimed subject matter except for the last limitation of the claim that calls for automatically enhancing an appearance of an entire image via a mapping technique to produce the image with target levels for a mean value or variation value of pixels in the detected face(s) in the image. The Examiner, however, cites (1) Kado for teaching automatically enhancing an image's brightness based on measured brightness of imaged human faces, and (2) Fowler as disclosing a linear mean invariant transformation that enhances every strip of an image. Based on these collective teachings, the Examiner concludes that claim 1 would have been obvious (Ans. 4-6).

Appellants argue that the Examiner misconstrues Fowler since Fowler merely enhances the pixels of *a particular vertical strip*. Appellants emphasize that this individual enhancement on a strip-by-strip basis has no effect on *other* vertical strips. As such, Appellants contend, the *entire image* is not enhanced to make one of the strips have target levels for the mean or variation values contained in any one of the strips (App. Br. 10-11, 13, 14; Reply Br. 5-6; emphasis added).

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[5] Appellants argue independent claims 1, 8, 15, and 21 together as a group. *See* App. Br. 9-18. Appellants, however, present separate arguments in connection with independent claims 15 and 21 (App. Br. 15-17). Accordingly, we select (1) claim 1 as representative of a first group comprising claims 1, 2, 8-10, 27, 28, and 30-33, and (2) claim 15 as representative of a second group comprising claims 15, 21, and 29. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Appellants add that neither Schildkraut nor Kado teach or suggest enhancing the appearance of an entire image via the mapping technique including the target levels for mean or variation values of the human face pixels recited in claim 1. According to Appellants, Schildkraut merely teaches red eye reduction techniques (App. Br. 12), and Kado corrects "patches" of an imaged human face (App. Br. 12-13), but neither reference enhances the entire image as claimed (*Id.*).

Additionally, Appellants contend that the Examiner's combination of references is improper since Fowler's field of endeavor (sonar images) differs from that of Schildkraut and Kado (facial images). According to Appellants, it would be unlikely for artisans skilled in the art of facial recognition and image enhancement to look at the art of sonar images, let alone combine the references in the manner proposed by the Examiner (App. Br. 17-18).

The Examiner contends that Fowler's determination of a new mean and variance for each strip in the image corresponds to the recited target levels for each strip or image region. As such, the Examiner reasons, Fowler enhances the entire image since all strips are enhanced (Ans. 11). In this regard, the Examiner emphasizes that an entire image can be enhanced even by altering pixels in a portion of the image (Ans. 12). In any event, the Examiner further notes that even if all faces in a particular image have a common target level of mean or variation, Fowler's teaching still applies since all of these faces can be considered collectively as a region of the image—a region that can likewise be enhanced to have such target values in accordance with Fowler's technique (Ans. 11-12).

Claims 15, 21, and 29

Regarding representative claim 15, Appellants argue that the cited prior art does not disclose that the target levels for a mean or variation value are desirable lightness and contrast levels that are determined through a determination of "*human visual preferences*" as claimed (emphasis added). According to Appellants, Kado's brightness correction is not based on human visual preferences, but rather is performed to make the face images more uniform for more accurate comparisons (App. Br. 15-16; Reply Br. 6; emphasis added). Appellants add that while Fowler's enhancement improves distinguishing lofargram signals from noise, and Schildkraut reduces redeye effects in images, these techniques are purportedly not based on human visual preferences (App. Br. 16-17; Reply Br. 6-7).

The Examiner takes the position that Kado's adjustment of lightness values can change contrast accordingly (Ans. 13). In any event, the Examiner notes that Fowler's adjusting pixel values to achieve a desired variance value also results in a contrast change (*Id.*). Lastly, the Examiner notes that using target values that are desirable lightness and contrast levels determined in accordance with human visual preferences is known in the art as evidenced by Appellants' own Specification. According to the Examiner, since a human being would be viewing the images, there would have been ample reason to apply this technique (*Id.*).

The issues before us, then, are as follows:

ISSUES

(1) Have Appellants shown that the Examiner erred in finding that Schildkraut, Kado, and Fowler collectively teach or suggest automatically

enhancing the appearance of an entire image via a mapping technique to produce the target levels for a mean or variation value of pixels in one or more detected human faces in the image such that the pixels in the face(s) have those target levels in rejecting claim 1 under § 103?

(2) Have Appellants shown that the Examiner erred in finding that Schildkraut, Kado, and Fowler collectively teach or suggest target levels that have desirable lightness and contrast levels determined in accordance with human visual preferences in rejecting claim 15 under § 103?

(3) Is the Examiner's reason to combine the teachings of these references supported by articulated reasoning with some rational underpinning to justify the Examiner's obviousness conclusion?

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence:

Schildkraut

1. Schildkraut discloses a technique for detecting eye color defects in digital images 10 (e.g., "redeye" effects caused by light from a camera flash unit). Specifically, Schildkraut's process (1) detects skin-colored regions in a digital image; (2) searches the skin-colored regions for groups of pixels with a redeye defect color characteristic; and (3) corrects the color of those pixels (Schildkraut, Abstract; col. 1, ll. 5-21; Fig. 1).

2. Schildkraut's technique fits an ellipse to individual skin color sub-maps to determine whether the skin-colored region in the image is a human face for subsequent processing (Schildkraut, col. 4, l. 13 – col. 5, l. 4; Figs. 2 and 6).

Kado

3. Kado discloses a system for identifying a person by (1) inputting a face image; (2) extracting "feature points" related to a face from the image (e.g., eye, nose, mouth, etc.); (3) dividing the face image into "patches" (e.g., triangles) in accordance with predetermined rules; (4) extracting a "feature amount" for each patch to describe the face image as a set of such feature amounts to describe a person; and (5) comparing the extracted feature amounts with the feature amounts of each person in a database (Kado, Abstract; col. 1, l. 63 – col. 2, l. 3; Figs. 1 and 2).

4. According to Kado, a "feature amount" can include the average brightness of each patch or, alternatively, the difference in brightnesses between adjacent patches (Kado, col. 2, ll. 3, 4, 11-13).

5. In one embodiment, Kado's system corrects brightness of the face image to prevent misjudgement due to a difference in the position of the light source in photographing. To this end, "feature amounts extracting section 16" extracts the brightness and normal vectors of each patch. By observing the brightness distribution over the respective parts of the face image, the light source's position and direction can be estimated which forms the basis for brightness adjustments of particular patches (Kado, col. 7, ll. 23-52; Fig. 14).

Fowler

6. Fowler discloses a method for enhancing lofargram[6] data images utilizing a rule base. The system takes plural sequentially-occurring vertical frequency strips of a lofargram data image and computes an estimate for the mean and variance of each vertical frequency strip. Then, a linear transformation utilizing a rule base is applied to each pixel of the vertical frequency strip to improve the clarity of the lofargram data image (Fowler, Abstract).

7. Figure 1 of Fowler details this process. As shown in that figure, lofargram image data 2 is segmented into vertical frequency strips and the mean and variance are computed for each strip. The rule base then converts the strip's old mean and variance into a new, enhanced mean and variance for that strip (Fowler, col. 3, ll. 4-23; Fig. 1 (Steps 3-5)).

8. The new mean and variance are then used to determine a scaling and biasing factor for the strip that enhances the strip to a visual range more easily viewed by the human eye (Fowler, col. 3, ll. 19-23; Fig. 1 (Step 6)).

9. Using the scaling and biasing factors from surrounding vertical frequency strips, the scaling and biasing for each pixel within a strip may be interpolated. The enhanced strips are then stitched back together providing a complete, enhanced lofargram image (Fowler, col. 3, ll. 23-30; Fig. 1 (Steps 7 and 8); col. 6, ll. 48-58).

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[6] According to Fowler, "'lofargram' refers to low frequency analyzing and recording gram data" (Fowler, col. 2, ll. 9-10). Additionally, Fowler notes that a lofargram data image, such as that shown in Figure 2a, is a frequency versus time representation of data output from a spectrum analyzer. These images are utilized in sonar detection devices to record sound frequencies detected over time (Fowler col. 3, ll. 32-37; Fig. 2a).

10. Fowler refers to Steps 5 through 7 of Figure 1 as "the enhancement operation" (Fowler, col. 3, ll. 26-28).

11. Fowler notes that image enhancement techniques are broadly applied to various types of images including, among other things, x-ray images and photographs (Fowler, col. 1, ll. 11-20).

Appellants' Specification

12. According to the Specification, "[a]t least one study has shown that people prefer to look at images, such as photographs and digital images, with certain levels of lightness and contrast, i.e., there are desirable levels for a mean value and/or a variation value . . . of the pixel values in the face region" (Spec. 5:13-16).

PRINCIPLES OF LAW

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

Discussing the question of obviousness of claimed subject matter involving a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 550 U.S. 398, 127 S. Ct. 1727 (2007), explains:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary

> skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [*v. AG Pro, Inc.*, 425 U.S. 273 (1976)] and *Anderson's-Black Rock*[, *Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *Id.* at 1740-41. Such a showing requires

> "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness" . . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

Id. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

If the Examiner's burden is met, the burden then shifts to the Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

> Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is

> reasonably pertinent to the particular problem with which the inventor is involved.

In re Bigio, 381 F.3d 1320, 1325 (Fed. Cir. 2004).

ANALYSIS

Claims 1, 2, 8-10, 27, 28, and 30-33

Based on the record before us, we find no error in the Examiner's obviousness rejection of representative claim 1 which calls for, in pertinent part, automatically enhancing the appearance of an entire image via a mapping technique to produce the target levels for a mean or variation value of pixels in one or more detected human faces in the image such that the pixels in the face(s) have those target levels.

First, while Fowler determines an enhanced mean and variance for individual vertical frequency strips of the image data essentially on a strip-by-strip basis (FF 7), this enhancement ultimately enhances the appearance of the entire image after stitching the enhanced strips together. *See* FF 9 (noting that the enhanced strips are then stitched back together providing a *complete*, *enhanced* lofargram image (emphasis added)). As such, even if we assume that Fowler's method is limited to enhancing individual strips, nothing in the claim precludes such a piecemeal enhancement technique that collectively enhances the image's overall appearance.

In this regard, the Examiner's point that the appearance of the entire image can be enhanced even by altering pixels in a portion of the image (Ans. 12) is well taken. Even limited alterations can enhance the overall appearance of an image—or do just the opposite. For example, a single facial feature—the smile—in the famous Mona Lisa painting is regarded as

one of the most fascinating aspects of this work of art (and, indeed, any work of art). Altering just this one facial feature in a digitized version of this painting would surely detract from the appearance of the image as a whole (i.e., the entire image) as the subject's enigmatic facial expression is a significant aspect of the masterpiece in view of its visual effect on the viewer.[7] Therefore, even enhancing an image in part (e.g., using a piecemeal enhancement technique as in Fowler) can enhance the appearance of the entire image in terms of visual impact on the viewer.

In any event, despite Fowler's enhancement technique being performed on a strip-by-strip basis, it is not performed in isolation as Appellants seem to suggest. Rather, the enhancement operation includes Step 7 (FF 10), namely interpolating the scaling and biasing for each pixel within a strip *using the scaling and biasing factors from surrounding vertical frequency strips* (FF 9; emphasis added). As Fowler indicates, these scaling and biasing factors enhance the strip to a visual range more easily viewed by the human eye (FF 8).

The clear import of this discussion is that the appearance of the image *as a whole* is enhanced by the individual enhancement of strips comprising that image. That this enhancement technique of a particular strip involves image data from surrounding strips (FF 9) only bolsters our conclusion that the entire image would be enhanced using this technique. We further note

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[7] *See* Philip Cohen, *Noisy Secret of Mona Lisa's Smile*, NewScientist, June 23, 2004, *at* http://www.newscientist.com/article/dn6056 (last visited Feb. 20, 2009); *see also* Louvre Museum Official Website, *A Closer Look: A Closer Look at the Mona Lisa*, *available at* http://www.louvre.fr/llv/dossiers/detail_oal.jsp?CONTENT%3C%3Ecnt_id=10134198673229908&CURRENT_LLV_OAL%3C%3Ecnt_id=10134198673229908&bmLocale=en (last visited Feb. 20, 2009).

that Kado at least suggests enhancing an entire image based on the relative brightnesses among different patches of a facial image. *See* FF 4 and 5.

We see no error in combining this teaching with the other cited references to arrive at the claimed invention as the Examiner proposes. First, we see no reason why Schildkraut's image enhancement system with face recognition (FF 1 and 2) combined with Kado's face image enhancement technique (FF 3-5) would not benefit from an enhancement technique such as that disclosed by Fowler which likewise seeks to improve clarity of the image (FF 6). Although Schildkraut enhances the facial images via a color correction technique (FF 1) and Kado's enhancement pertains to an identification system (FF 3), we nonetheless see no reason why improving the clarity of the image in accordance with Fowler's teachings would not benefit the Schildkraut/Kado system to, among other things, enhance discerning and distinguishing visual details in the image for processing and viewing. In short, the Examiner's combining the respective teachings of the cited references is tantamount to the predictable use of prior art elements according to their established functions—an obvious improvement. *See KSR*, 127 S. Ct. at 1740.

While it is true that Fowler's system is used for lofargram data images which are used in sonar detection devices (FF 6), we nonetheless see no reason why the reference's fundamental teachings could not be applied to visual image enhancement systems such as Schildkraut and Kado. Ultimately, Fowler is concerned with improving the visual quality of acquired image data using enhancement techniques which Fowler at least suggests can be "broadly applied" to various types of images, including photographs. *See* FF 11. We therefore find Fowler constitutes analogous art

since it is in the same field of endeavor (image enhancement) and, moreover, reasonably pertinent to the problem Appellants are trying to solve, namely image enhancement. *See Bigio*, 381 F.3d at 1325. As such, we find the references reasonably combinable. Moreover, the Examiner's reason to combine the teachings of the cited prior art is amply supported by articulated reasoning with some rational underpinning to justify the Examiner's obviousness conclusion

For the foregoing reasons, Appellants have not persuaded us of error in the Examiner's rejection of representative claim 1. Therefore, we will sustain the Examiner's rejection of that claim, and claims 2, 8-10, 27, 28, and 30-33 which fall with claim 1.

Claims 15, 21, and 29

We will also sustain the Examiner's rejection of representative claim 15 which calls for, in pertinent part, determining target levels that have desirable lightness and contrast levels in accordance with human visual preferences. First, we agree with the Examiner (Ans. 13) that since humans would be viewing the digital images in Schildkraut (*see* FF 1), we see no reason why the target levels of lightness and contrast could not be determined via human visual preferences as claimed, particularly since it is well known that people tend to prefer certain levels for pixels in the face region (FF 12). While Kado's brightness adjustment technique is used in connection with an automatic identification system (FF 3) and prevents misjudgement due to differences in light source positioning in photography (FF 5), we see no reason why this fundamental brightness correction technique could not be applied to other image correction paradigms based on

human visual preferences, such as those disclosed by Schildkraut. That Kado's correction technique is based on the position of the light source used for the photograph and its concomitant effect on the image (FF 5)—a factor which itself can be a "human visual preference"—only bolsters this conclusion.

Furthermore, the fact that Fowler's enhancement technique is used in connection with visual representations of sonar data (FF 6) hardly means that its target level determination would not be based, at least in part, on human visual preferences. Fowler determines an updated mean and variance that is used to determine a scaling and biasing factor that enhances a strip to a visual range *more easily viewed by the human eye* (FF 8; emphasis added). Simply put, the very point of Fowler's enhancement technique is to account for "human visual preferences," namely to make the image easier to see. As such, we find ample reason on this record to apply Fowler's technique to the Schildkraut/Kado combination as the Examiner proposes.

For the foregoing reasons, Appellants have not persuaded us of error in the Examiner's rejection of representative claim 15. Therefore, we will sustain the Examiner's rejection of that claim, and claims 21 and 29 which fall with claim 15.

OTHER REJECTIONS

Likewise, we will sustain the Examiner's obviousness rejections of (1) claims 3, 4, 11, 12, and 18 over Schildkraut, Kado, Fowler, and Center (Ans. 7-8), and (2) claims 6, 14, 20, and 25 over Schildkraut, Kado, Fowler, and Acker (Ans. 8-9). We find that Appellants have not particularly pointed out errors in the Examiner's reasoning to persuasively rebut the Examiner's

prima facie case of obviousness, but merely noted that the addition of Center and Acker fails to cure the deficiencies of the cited prior art in connection with the independent claims (App. Br. 19-20). Thus, we are not persuaded that the Examiner erred in rejecting these claims for the same reasons discussed above. The rejections are therefore sustained.

CONCLUSION

Appellants have not shown that the Examiner erred in rejecting claims 1-4, 6, 8-12, 14, 15, 18, 20, 21, 25, and 27-33 under § 103.

ORDER

The Examiner's decision rejecting claims 1-4, 6, 8-12, 14, 15, 18, 20, 21, 25, and 27-33 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

ELD

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